Project #3

STAT 878

Spring 2024

Complete the problems below. Within each part, include your R program output with code inside of it and any additional information needed to explain your answer. Your R code and output should be formatted in the exact same manner as in the course notes.

1. (21 total points) The data file Earthquakes.csv provides the number of magnitude 5.0 or higher earthquakes worldwide per year since 2000. Use the number of earthquakes per year in the data set for this problem. For an ARIMA(1,0,0) model, complete the following parts.
   1. (3 points) State the estimated model.
   2. (3 points) Compute the forecasts for m = 1, 2, 3. Use predict() for these calculations. Make sure to use the proper notation when stating these values. For example, there should be a  in your answer.
   3. (3 points) Compute the forecasts for m = 1, 2, 3. Program into R the expression for the forecasts and use this to complete the calculations without predict(). Present a table of the values similar to those given in the forecasting course notes.
   4. (3 points) Compute the standard deviation of the forecast error for m = 1, 2, 3. Use predict() for these calculations. Make sure to use the proper notation when stating these values.
   5. (3 points) Compute the 95% confidence intervals for the future values with m = 1, 2, 3; make use of the predict() function for these calculations.
   6. (3 points) Plot the observed data, the forecasts for m = 1, 2, 3, and the confidence intervals for m = 1, 2, 3.
   7. (3 points) Suppose you are a seismologist being interviewed by the news media for a video meant for the general public. They ask you “How many earthquakes will occur next year?” Provide a response to this question with an appropriate explanation!
2. (5 points) Write a function to compute forecasts and (1-α)100% confidence intervals for the future values. This function should have arguments for 1) model fit from arima(), 2) m, 3) α. The returned object from the function should be a data frame with columns for the forecasts and the confidence intervals. Demonstrate the function works by computing the forecasts and intervals again for #1.
3. (8 total points) For an ARMA(2,1) with μ = 0, complete the following.
   1. (4 points) Find  for m = 1 and 2.
   2. (4 points) Find  for m = 1 and 2.